

CLAIMS

What is claimed is:

1. A semiconductor device, comprising:
a substrate;
5 a polymer dielectric over the substrate; and
at least one active device comprising an organic semiconductor material and a passive layer.
2. The semiconductor device of claim 1, wherein the polymer dielectric
10 comprises at least one selected from the group consisting of polyimides, fluorinated polyimides, polysilsequioxanes such as hydrogen polysilsequioxanes, methyl polysilsequioxanes, butyl polysilsequioxanes, and phenyl polysilsequioxanes, benzocyclobutenes (BCB), fluorinated benzocyclobutene, polyphenylene, polysilazanes, polyphenylquinoxaline, copolymers of 2,2-bistrifluoromethyl-4,5-
15 difluoro-1,3-dioxole, perfluoroalkoxy resin, fluorinated ethylene propylene, fluoromethacrylate, poly(arylene ether), fluorinated poly(arylene ether), fluorinated parylenes, poly(p-xylylenes), fluorinated poly(p-xylylenes), parylene F, parylene N, parylene C, parylene D, amorphous polytetrafluoroethylene, polyquinoline, polyphenylquinoxalines, and polymeric photoresist materials.
- 20 3. The semiconductor device of claim 1, wherein the polymer dielectric comprises a self patternable material.
4. The semiconductor device of claim 1, wherein the polymer dielectric
25 has a glass transition temperature or a melting point of about 125° C. or higher and about 425° C. or less.
5. The semiconductor device of claim 1, wherein the polymer dielectric has a dielectric constant below about 3.
- 30 6. The semiconductor device of claim 1 further comprising a conductive

polymer.

7. The semiconductor device of claim 1, wherein the organic semiconductor material comprises at least one selected from the group consisting of

5 polyacetylene; polydiphenylacetylene; poly(t-butyl)diphenylacetylene; poly(trifluoromethyl)diphenylacetylene; polybis(trifluoromethyl)acetylene; polybis(t-butyl)diphenyl)acetylene; poly(trimethylsilyl) diphenylacetylene; poly(carbazole)diphenylacetylene; polydiacetylene; polyphenylacetylene; polypyridineacetylene; polymethoxyphenylacetylene; polymethylphenylacetylene;

10 poly(t-butyl)phenylacetylene; polynitro-phenylacetylene; poly(trifluoromethyl)phenylacetylene; poly(trimethylsilyl)pheylacetylene; polydipyrrylmethane; polyindoqiunone; polydihydroxyindole; polytrihydroxyindole; furane-polydihydroxyindole; polyindoqiunone-2-carboxyl; polyindoqiunone; polybenzobisthiazole; poly(p-phenylene sulfide); polyaniline; polythiophene;

15 polypyrrole; polysilane; polystyrene; polyfuran; polyindole; polyazulene; polyphenylene; polypyridine; polybipyridine; polyphthalocyanine; polysexithiofene; poly(siliconoxohemiporphyrzine); poly(germaniumoxohemiporphyrzine); poly(ethylenedioxythiophene); polymetallocene complexes; and polypyridine metal complexes.

8. The semiconductor device of claim 1, wherein the passive layer comprises at least one selected from the group consisting of copper sulfide, copper rich copper sulfide, copper oxide, copper selenide, copper telluride, manganese oxide, titanium dioxide, indium oxide, silver sulfide, gold sulfide, iron oxide, cobalt

25 arsenide, and nickel arsenide.

9. The semiconductor device of claim 1, wherein at least one active device comprises a first and a second electrode, a passive layer adjacent the first electrode, and the organic semiconductor material adjacent the second electrode.

10. A semiconductor device, comprising:

a substrate;
a polymer dielectric over the substrate; and
at least one polymer memory device comprising an organic
semiconductor material and a passive layer between two electrodes.

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11. The semiconductor device of claim 10, wherein the polymer dielectric
comprises at least one selected from the group consisting of polyimides, fluorinated
polyimides, polysilsequioxanes such as hydrogen polysilsequioxanes, methyl
polysilsequioxanes, butyl polysilsequioxanes, and phenyl polysilsequioxanes,
10 benzocyclobutenes (BCB), fluorinated benzocyclobutene, polyphenylene,
polysilazanes, polyphenylquinoxaline, copolymers of 2,2-bis(trifluoromethyl)-4,5-
difluoro-1,3-dioxole, perfluoroalkoxy resin, fluorinated ethylene propylene,
fluoromethacrylate, poly(arylene ether), fluorinated poly(arylene ether), fluorinated
parylenes, poly(p-xylylenes), fluorinated poly(p-xylylenes), parylene F, parylene
15 N, parylene C, parylene D, amorphous polytetrafluoroethylene, polyquinoline,
polyphenylquinoxalines, and polymeric photoresist materials.

12. The semiconductor device of claim 10, wherein the polymer dielectric
has a glass transition temperature or a melting point of about 135° C. or higher and
20 about 400° C. or less.

13. The semiconductor device of claim 10, wherein the polymer dielectric
has a dielectric constant below about 2.4.

25 14. The semiconductor device of claim 10, wherein the polymer dielectric
is formed by one of spin-on techniques and chemical vapor deposition techniques.

15. The semiconductor device of claim 10, wherein the organic
semiconductor material comprises at least one selected from the group consisting of
30 polyacetylene; polydiphenylacetylene; poly(t-butyl)diphenylacetylene;
poly(trifluoromethyl)diphenylacetylene; polybis(trifluoromethyl)acetylene; polybis(t-

butyldiphenyl)acetylene; poly(trimethylsilyl) diphenylacetylene;
 poly(carbazole)diphenylacetylene; polydiacetylene; polyphenylacetylene;
 polypyridineacetylene; polymethoxyphenylacetylene; polymethylphenylacetylene;
 poly(t-butyl)phenylacetylene; polynitro-phenylacetylene; poly(trifluoromethyl)
 5 phenylacetylene; poly(trimethylsilyl)phenylacetylene; polydipyrrylmethane;
 polyindoquinone; polydihydroxyindole; polytrihydroxyindole; furane-
 polydihydroxyindole; polyindoquinone-2-carboxyl; polyindoquinone;
 polybenzobisthiazole; poly(p-phenylene sulfide); polyaniline; polythiophene;
 polypyrrole; polysilane; polystyrene; polyfuran; polyindole; polyazulene;
 10 polyphenylene; polypyridine; polybipyridine; polyphthalocyanine; polysexithiophene;
 poly(siliconoxohemiporphyrine); poly(germaniumoxohemiporphyrine);
 poly(ethylenedioxythiophene); polymetalocene complexes; and polypyridine metal
 complexes.

15 16. The semiconductor device of claim 10, wherein the passive layer
 comprises at least one selected from the group consisting of copper sulfide, copper
 rich copper sulfide, copper oxide, copper selenide, copper telluride, manganese oxide,
 titanium dioxide, indium oxide, silver sulfide, gold sulfide, iron oxide, cobalt
 arsenide, and nickel arsenide.

20 17. A semiconductor device, comprising:
 a substrate;
 a polymer dielectric over the substrate;
 at least one active device comprising an organic semiconductor
 25 material and a passive layer; and
 a conductive polymer adjacent at least one active device.

 18. The semiconductor device of claim 17, wherein the polymer dielectric
 has a glass transition temperature or a melting point of about 125° C. or higher and
 30 about 425° C. or less and a dielectric constant below about 3.

19. The semiconductor device of claim 17, wherein the polymer dielectric comprises at least one selected from the group consisting of polyimides, fluorinated polyimides, polysilsequioxanes such as hydrogen polysilsequioxanes, methyl polysilsequioxanes, butyl polysilsequioxanes, and phenyl polysilsequioxanes, benzocyclobutenes (BCB), fluorinated benzocyclobutene, polyphenylene, polysilazanes, polyphenylquinoxaline, copolymers of 2,2-bis(trifluoromethyl)-4,5-difluoro-1,3-dioxole, perfluoroalkoxy resin, fluorinated ethylene propylene, fluoromethacrylate, poly(arylene ether), fluorinated poly(arylene ether), fluorinated parylenes, poly(p-xylylenes), fluorinated poly(p-xylylenes), parylene F, parylene N, parylene C, parylene D, amorphous polytetrafluoroethylene, polyquinoline, polyphenylquinoxalines, and polymeric photoresist materials.

20. The semiconductor device of claim 17, wherein the active device comprises a polymer memory device comprising the organic semiconductor material and the passive layer between two electrodes, the organic semiconductor material comprising a conjugated polymer.